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A REJOINDER TO K.V.K. NEHRU

by Dewey B. Larson

THEORETICAL EVALUATION OF PLANCK'S CONSTANT

by K.V.K. Nehru

DIMENSIONS IN THE UNIVERSE OF MOTION

by Dewey B. Larson

A NOTE A METAPHYSICS

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A REJOINDER TO K.V.K. NEHRU

by Dewey B. Larson

In a letter published in the May 1975 issue of *Reciprocity* I stated that I preferred not to comment on articles submitted for publication because "I believe that it is very desirable to encourage free and open discussion of the (Reciprocal) theory and its applications, so that we can have the benefit of as many points of view as possible in extending and clarifying the theoretical structure. I want to avoid saying or doing anything that might give the impression that I am trying to discourage dissenting opinions." These considerations are still applicable, but I think that we have now reached the point where it would be appropriate to discuss the general situation with respect to the extension and refinement of the theory. The article by Dr. Nehru in the Autumn 1982 issue provides a good example of some of the points that need to be emphasized.

The first fact that should be noted is that the theory is derived in its entirety from the fundamental postulates; that is, it consists entirely of the postulates and their necessary consequences, without any content from other sources. This is very important, because it provides the basis for verifying the validity of the theory by application of the probability principles. In physical matters we cannot obtain mathematical certainty: a condition in which the probability of error is *zero*. We have to settle for what we may call physical certainty: a condition in which the probability of error is so small that it is negligible. This is attained by making a very large number of comparisons with the data from experience. Every comparison of this kind is a test of the theory, and each additional test that is made without finding a discrepancy reduces the probability that any discrepancy exists *anywhere*. But the theory cannot be tested by comparison with what little is known about a poorly understood phenomenon such as the pulsars. The definitive test is the comparison with the observational knowledge about phenomena that are well known and clearly understood. Since the Reciprocal System has already passed this test in thousands of comparisons, its validity is as clearly established as is possible for a physical theory (even though this fact is not yet realized by the scientific community in general).

It needs to be recognized, however, that the fixed character of the theory that enables establishing its validity also imposes some severe constraints on its further development. In particular, it prohibits introducing any additional assumptions, or anything from observation, in developing the details of application of the theory to specific areas. In order to preserve the status of the theory as a single, integral entity that can be tested as a whole these details must be derived in the same manner as the major conclusions; that is, as necessary consequences of the basic postulates. During the years that have elapsed since the founding of what is now the ISUS, many of those who have participated in the activities of the organization have decided that they would be better satisfied if the conclusions derived from the theory in

certain areas were modified. But as I have just pointed out, the chief merit of the theory, the characteristic that enables us to verify its validity, is its status as a fixed structure, one that we *cannot* modify to suit our preferences or prejudices.

It does not follow that those of us who have undertaken to develop the details of the theory have necessarily arrived at the correct conclusions in every case. None of us makes any claim to infallibility. Thus it is entirely in order for anyone to take exception to a previous conclusion, providing that he can show that a different conclusion can be derived from a development of the consequences of the fundamental postulates. But if the dissenting opinion is based, either totally or partially, on considerations other than those derived from the postulates of the Reciprocal System it is an expression of a *different* theory, and it has no claim to a favorable reception by those of us who are working to extend and amplify the Reciprocal System.

This task that we now have ahead of us is to enlarge our area of coverage and apply it to more of the details, meanwhile reexamining and refining the conclusions previously reached that may involve uncertain aspects. We are not looking to see if the theory can produce the right results. We already know, on the strength of the laws of probability, that it is capable of producing the answers that we want. Whether or not we actually find them is not a test of the theory; it is a test of our ability to apply the theory. Even though we have the correct foundation, the answers do not appear automatically. Sometimes they are quite obvious, but more often we have to dig them out.

There are, of course, a multitude of areas still to be covered by the theoretical development. But the issues involved in these areas, such as the list of questions in Dr. Nehru's article, are not "tests of the Reciprocal System," as he calls them. The required tests have already been carried to the point where the results of additional tests have no significance. Dr. Nehru's questions merely amount to a list of some of the things that should be investigated by anyone who undertakes to extend the previous consideration of the pulsars into more detail. This kind of information serves a useful purpose, and we should welcome Dr. Nehru's contribution, but the only thing it "tests" is out ability as investigators.

As it happens, I have considered all of the points mentioned by Dr. Nehru in the course of the investigations that I have undertaken during the past several years in connection with the preparation of the new edition of *The Structure of the Physical Universe*. These investigations have disclosed that in all of the cases that Dr. Nehru mentions, the development of the Reciprocal System of theory produces answers that agree with the known facts. In one instance some modification of the previously published conclusions is required. In all of the other cases my finding is that the previous conclusions are correct, as far as they go.

Most of these matters require more explanation than I can give here, but the first three are relatively simple, and a few comments about them will serve to illustrate the points that I have been making. Dr. Nehru's first question is why the quasars do not pulse as the pulsars do. The answer is that they actually *do* pulse as they pass through the pulsation zone, but we cannot detect the pulses because they originate from billions of stars and the radiation from these stars is not synchronized. In the second item he points out that the duration of the pulse should be in the range of one unit of time, rather than in seconds, as observed. But the unit of time applies to the unit of mass. The observed pulse is a composite of a vast number of sub-pulses, and it continues as long as there are mass units in the line of travel.

The third item is the reason for two peaks in the pulses of some pulsars. Dr. Nehru says that "no explanation has been offered for this from the framework of the Reciprocal System." This is true. But it is true only because, prior to my recent studies, the results of which have not yet been published, no one had gotten around to examining the question. Just as soon as I had occasion to take a look at the situation, I found the answer obvious. From the explanation of the nature of the pulsars that we derive from theory, it follows that the shape of the pulse is determined by the shape of the pulsating object, specifically its radio structure. The young pulsars, type S as they are known to the astronomers, have pulses with single peaks, which are quite evidently produced by globular structures. The older pulsars, type C, have had time to develop the typical dumbell form of radio structure, and the double peak simply reflects the existence of this double structure.

These results are typical of those that I have obtained in the astronomical investigation (which I expect to complete in a few more months). Throughout the astronomical field I have found that the application of the Reciprocal System of theory provides simple and logical answers to the outstanding problems. Inasmuch as the extreme conditions to which astronomical objects are subjected stretch physical theory over the widest possible range of application, the fact that the principles and relations developed in the more accessible realms of physical science can be extended to astronomical phenomena without any serious difficulty is very significant.

I do not mean to imply, however, that this is an easy task. In a separate communication Dr. Nehru has raised another issue that brings out the point that exploration of a totally new field of thought, such as that which we are undertaking, is not a simple matter. He notes that my explanation of the destruction of the heavy elements at the stellar temperature limits asserts that the combined space displacement of the ionization and thermal motion neutralizes the rotational time displacement of the atom, and reduces all motion to the linear form. In order to accomplish this, Dr. Nehru comments, the thermal motion must, in some way, be converted to rotation. "The thermal motion, being a *linear* space displacement, cannot directly destroy the atomic rotation," he says. Actually this is not correct. It would be true if we were deal-

ing with vectorial motion, but all of the motions with which we are here concerned are scalar, and the scalar situation is quite different.

This is a good illustration of the fact that, even though the theory has the answers that we are looking for, these answers are by no means self-evident. I believe that I have a reasonably good understanding of the primary consequences of the postulates of the Reciprocal System. Furthermore, I recognized the scalar nature of the basic motion, and emphasized it in my first book, published in 1959. But it was not until two or three years ago that I had a clear enough understanding of scalar motion to be able to answer the point that Dr. Nehru now brings up, if anyone had raised the issue earlier.

The key to this situation (and to most other questions about the basic motions as well) is a recognition of the way in which rotational scalar motion differs from rotational vectorial motion. The difference can easily be seen if the motion of a point the surface of a rotating ball (a vectorial motion) is compared with that of a point on the surface of a rotating expanding balloon such as the one that I described in *The Neglected Facts of Science*. In the vectorial case the primary motion of the point is transverse, and the acceleration toward the axis of rotation causes it to move in a circle around that axis. In the scalar case the primary motion of the point is radial, and the rotation of its representation in the reference system causes the point to move spirally outward. The rotation of the atom is a scalar motion similar to the rotation of the expanding (or contracting) balloon. The thermal motion is a linear scalar motion that simply adds to, or subtracts from, the magnitude of the radial motion whose direction is being changed by the rotation. Attainment of equality between the scalar magnitudes, the space and time displacements, thus destroys the rotation.

In my opinion, there is no doubt that whatever problems may exist in other physical areas can similarly be solved by application of the basic principles and relations that we have derived from the postulates. I am therefore suggesting to those who are inclined to tackle these problems that you ought to approach them with the firm conviction that the answers exist, and that they can be obtained if sufficient time and effort are applied, along with a little ingenuity.

THEORETICAL EVALUATION OF PLANCK'S CONSTANT

by K.V.K. Nehru

The analysis of physical quatities into their space-time components, made possible by the application of the Reciprocal System, throws fresh illumination on the nature and significance of these quantities. Larson demonstrates that the result of applying the discrete unit postulate to the dimensions of physical quantities results in the principle that the dimensions of the numerator of the space-time expression of any real physical quantity cannot be greater than those of the denominator. Quoting Larson[1]:

> The most notable of the quantities excluded by this dimensional principle is "action." This is the product of energy, t/s, and time t, and in space-time terms it is t^2/s Thus it is not admissible as a real physical quantity . . . The equation connecting the energy of radiation with the frequency is
>
> $$E = h\nu$$
>
> where h is Planck's constant . . . expressed in terms of action.
>
> It is clear, however, from the explanation of the nature of the photon of radiation . . . that the so-called "frequency" is actually a speed. It can be expressed as a frequency only because the space that is involved is always a unit magnitude. In reality, the space dimension belongs with the frequency, not with the Planck's constant. When it is thus transferred, . . . the equation for energy of radiation is [in space-time terms]
>
> $$t/s = t^2/s^2 * s/t \qquad \langle 1 \rangle$$

In *The Structure of the Physical Universe* Larson derives the value of Planck's constant on this basis, making use of the gravitational constant. In this paper I attempt to do the same, but without bringing the gravitational constant into the picture, with the hope of showing the factors involved more clearly.

We will adopt the suffix c to denote a quantity expressed in the conventional units, no suffix to denote the quantity expressed in the natural units, and suffix n to denote the magnitude of the natural unit of a quantity expressed in terms of the conventional units.

Remembering that, on the natural unit basis, any unit of a physical quantity is also the unit of the corresponding inverse quantity, every unit of energy is both a unit of t/s and a unit of s/t, each in its

proper context,[2] from eq. <1> the quantitative relationship between E natural units of energy and u natural units of speed can be expressed as

$$E = (1/1)\ u$$

since the numerical magnitude of the t^2/s^2 term is $(1/1)^2$ in natural units. The speed u is given by the quotient of S natural units of space and T natural units of time. Therefore,

$$E = S/T$$

Now we will introduce the conventional units into the equation, but will do so only in the case of those quantities which we want expressed in the conventional units finally. Since $E = E_c / E_n$ and $T = T_c / T_n$, we have

$$E_c = (E_n * T_n)\ S/T_c \qquad <2>$$

However, from what has been quoted earlier, we note that the numerical magnitude S in eq. <2> is 1, since the vibration is confined to one natural unit of space. The lack of recognition of the true status of the frequency term as a speed term and expressing every quantity in terms of the conventional units (i.e., including 1 cm in place of S) therefore has the effect of overstating the numerical value on the RHS by a factor of 1 cm/S_n. As such, the RHS must be multiplied by the reciprocal of this factor. Thus,

$$E_c \text{ (in ergs)} = (E_n * T_n * S_n / 1 \text{ cm})\ 1/T_c \text{ (in sec)} \qquad <3>$$

Or, replacing 1/T by v, the frequency in Hertz,

$$E_c = (E_n * T_n * S_n / 1 \text{ cm})\ v \qquad <4>$$

from which we have Planck's constant as

$$h = E_n * T_n * S_n / 1 \text{ cm} \qquad <5>$$

There are two additional factors to be considered before we can arrive at the numerical magnitude of h. Firstly, since the photon vibration is limited to the time-region while measurements appertain to the outside region, this value of h is to be reduced by the interregional ratio R. Hence,

$$h = (E_n * T_n * S_n)/(r * 1 \text{ cm}) \qquad <6>$$

The second factor is concerned with the effect of the secondary mass component s. As long as mass is expressed in the dynamical unit of gram, it becomes necessary to take account of the discrepancy between the units of primary mass and inertial mass. Thus, when adopting the gram-unit, the mass term is to be multiplied by a factor of 1+s, where 1

is the primary mass and s the secondary mass.[4] In the present case, since energy is t/s while mass is t^3/s^3, the multiplying factor is $(1+s).^{1/3}$ Thus,

$$h = [(E_n * T_n * S_n)/(R * 1\ cm)] * [1+s]^{1/3} \qquad <7>$$

Adopting the values from Ref. 3,

$E_n = 1.49175 * 10^{-3}$ erg

$T_n = 1.520655 * 10^{-16}$ sec

$S_n = 4.558816 * 10^{-6}$ cm

R = 156.4444 (Ref. 5),

and for the secondary mass calculation, from Ref. 6,

m, magnetic mass = 0.00639205,

we have the value of Planck's constant as

$$h = 6.6243162 * 10^{-27} \text{ erg-sec} \qquad <8>$$

But it must be noted that m, the magnetic mass, is not the only component of the secondary mass s. This is because in the particles with unit net displacement (like, for example, M $\frac{1}{2}$-$\frac{1}{2}$-0), there is *always* an initial unit of electric mass, of magnitude 0.0005787. Thus 1+s becomes 1.00697075. Substituting this in equation <7> gives

$$h = 6.6255857 * 10^{-27} \text{ erg-sec} \qquad <9>$$

This is in close agreement with the experimental value of $6.6256 * 10^{-27}$ erg-sec (within an error of $2.16 * 10^{-4}$ percent).

REFERENCES

1. D. B. Larson, *Nothing But Motion*, (North Pacific Publishers: Portland, OR, 1979), p. 152
2. *Ibid*., p. 169 (see lines 6-4 from bottom).
3. *Ibid*., p. 160.
4. *Ibid*., p. 170.
5. *Ibid*., p. 162.
6. *Ibid*., p. 164.

DIMENSIONS IN THE UNIVERSE OF MOTION

by Dewey B. Larson

In my publications I have followed a general policy of not duplicating material that is readily available in the textbooks, in order to conserve space for the new ideas tht I am presenting. I therefore do not define terms that are in general use, commenting on the usage only where I have introduced some new concept, or have modified the meaning of a term. There was some confusion about my usage of the term "direction" originally, and I had occasion to discuss this matter in some of my publications. (See, for instance, *Nothing But Motion*, p. 48). These explanations apparently took care of the problem, as I have heard nothing about directions lately. It now appears that some misunderstandings also exist with respect to my use of the term "dimension." Some comments on the usage of this term may therefore be helpful.

The dimensional situation is complicated by the fact that I necessarily have to use the term in its broadest sense, whereas it is more generally used with a very restricted meaning. From the general standpoint, "dimension" is a mathematical term that may be, but is not necessarily, capable of being represented in geometric form. An n-dimensional quantity is simply one that requires n independent numbers for definition. As one dictionary says, by way of illustration, "a^2b^2c is a term of five dimensions." Within a certain limited range, dimensions of space may be represented in the conventional reference system, and because this usage is so common, the qualification "spatial" is commonly omitted. Thus we say that a cube is three-dimensional, meaning that it extends into three vectorial dimensions of space. But we also say that space is three-dimensional, and here we mean something different. We do not mean that space extends into three dimensions of space. That statement is an absurdity. What we mean is that three scalar magnitudes — numbers — are required in order to define a location in space.

The space of the conventional reference system is three-dimensional. But it takes all three of these spatial dimensions to represent one dimension of motion in space. Consequently, the present-day physicist, who does not recognize the existence of anything outside the reference system, deal only with *one* dimension of motion. The prevailing opinion, therefore, is that all real motion can be represented geometrically in the reference system. Where the theorists have to resort to multiple dimensions in order to explain some of the more difficult experimental results, an expedient that has become quite common since observation and measurement have penetrated into the smaller, faster, and more distant regions of the universe, they portray the extra dimensions as in some way unreal. Heisenberg, for example, characterizes the atom as existing in an "abstract multi-dimensional space," whatever that means.

My finding is that the real physical universe extends beyond the one dimension of motion represented in the reference system. What I have done is to take the physicists' vague idea of multiple dimensions, and

put it into concrete form. This was the key to the development of a complete and consistent physical theory. One of the requirements for a full understanding of that theory is a recognition that the dimensions of motion are *mathematical*. When I refer to dimensions in my works, this term has no geometrical connotations, except where so specified. Dimensions are scalar magnitudes, just numbers. Different phenomena involve different numbers of independent magnitudes. It follows that the number of dimensions with which we are concerned depends on the particular phenomenon with which we are dealing.

The first unit of motion, from the spatial zero to unit speed, the speed of light, is one-dimensional in space. The second unit is one-dimensional in time, but because we base our reference system on a spatial speed of zero, it appears in that reference system as a dimension of motion in space *plus* a dimension of of motion in time (to the extent that the reference system can respond to motion in time) from an inverse speed of unity to the temporal zero. On this linear basis, there are two dimensions of motion between zero spatial motion and zero temporal motion; that is, it takes two numbers, one representing the quantity of motion in space and one representing the quantity of motion in time, to express the total magnitude of the motion difference between these two zero levels. Here, then, in this simple situation, we already have a case where the number of dimensions is either one or two, depending on the nature of the phenomenon with which we are dealing; that is, whether it is something that we refer to a zero base, or something that is necessarily referred to the natural base at unity. This is not all. Further dimensions may be introduced into the same situation because the one-dimensional motion that I have been describing can be *distributed* over three dimensions, in a manner similar to the way in which radiation from a light source is distributed. This does not change the one-unit magnitude, as the cube of one is still one. But if the two-unit magnitude is so distributed it extends to 2^3, or 8, dimensions.

Inasmuch as our base is the spatial zero, a speed of three units adds a second dimension of motion in space to the two-unit combination. The result, three units of speed equivalent, measured from the spatial zero, is equal to three units of inverse speed equivalent, measured from the temporal zero. Beyond this neutral level, the motion as a whole converts to motion in time. But as long as the total speed remains below the neutral level, any motion in time that may exist acts as a modifier of the magnitude of the motion in space, rather than causing an actual change of position in time. This is easily understood on a mathematical basis. If a small negative number is added to a larger positive number, the result is simply a reduction in the magnitude of the positive number. The second dimension of motion is thus a motion in the spatial equivalent of time.

From the foregoing it can be seen that there are six dimensions of motion between the spatial zero and the temporal zero. The basic fact is that the universe is three-dimensional. Beyond this, the number of dimensions that have to be taken into consideration depends on the par-

ticular feature of the universe with which we are dealing. Of course, all this is very complicated compared to a simple three-dimensional coordinate system, and many individuals would like to put it into some simpler form. But we are dealing with nature, and nature does not accomodate itself to our preferences. Physical theory claims to be able to deal with all of the modern discoveries without going beyond the one dimension of motion that can be represented in a spatial coordinate system. Conventional physics has found it necessary to place the small-scale phenomena of the physical universe in a strange half-world, the "abstract multi-dimensional space" that Heisenberg refers to, a world that is populated by "virtual" particles and other entities that admittedly do not "exist objectively." These ghostly denizens of the phantom sector of the physicists' universe do not obey the normal physical laws or the rules of logic, and are governed by mysterious "forces" of which there is no physical evidence. When all this is taken into consideration, it can easily be seen that I am not increasing the complexity of physical theory. I am merely taking the metaphysical ideas that are too vague to be useful in practice, and putting them into concrete form. The universe *is*, in fact, complex, and if we want to understand it we will have to meet it on its own terms.

A NOTE ON METAPHYSICS

by Dewey B. Larson

Some of the readers of my latest book, *The Neglected Facts of Science*, are apparently interpreting the conclusions of this work as indicating that the Reciprocal System of theory leads to a strict mechanistic view of the universe, in which there is no room for religious or other non-material elements. This is not correct. On the contrary, the clarification of the nature of space and time in this theoretical development removes the obstacles that have hitherto prevented science from conceding the existence of anything outside the boundaries of the physical realm.

In conventional science, space and time constitute a framework, or setting, within which the entire universe is contained. On the basis of this viewpoint, everything that exists, in a real sense, exists *in* space and *in* time. Scientists believe that the whole of this real universe is now within their field of observation, and they see no indication of anything non-physical. It follows that anyone who accepts the findings of conventional science at their face value cannot accept the claims of religion, or any other non-material system of thought. This is the origin of the long-standing antagonism between science and religion, a conflict which most scientists find it necessary to evade by keeping their religious beliefs separate from their scientific beliefs.

In the Reciprocal System, on the other hand, space and time are *contents* of the universe, rather than a container in which the universe exists. On this basis, the "universe" of space and time, the physical universe, to which conventional science is restricted, is only one portion of existence as a whole, the real "universe" (a word which means the total of all that exists). This leaves the door wide open for the existence of entities and phenomena outside (that is, independent of) the physical universe, as contended by the various religions and many systems of philosophy.

Inasmuch as the Reciprocal System is a theory of the *physical* universe only, it arrives at no conclusions as to the validity of the contentions of the various non-scientific schools of thought, but it removes all justification for the assertions that are frequently made to the effect that those contentions are scientifically impossible. Those scientists with strong religious convictions who are now looking askance at the Reciprocal System under the mistaken impression that it envisions a purely materialistic universe should, in fact, welcome it, because it removes the basic conflict between science and their religious beliefs.

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